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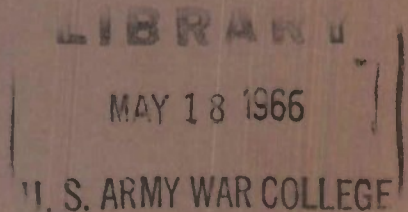
8 April 1966

MODERN WAR GAMING OF GROUND COMBAT IN THE UNITED STATES ARMY

By

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Modern War Gaming of Ground Combat in the United States Army

by

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Artillery

US Army War College
Carlisle Barracks, Pennsylvania
8 April 1966

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SUMMARY

The impact of operations research on military operations during World War II has resulted in a continuing growth of the application of its techniques to military problems. The partnership of the military and the scientist, which was initiated during World War II, appears to be firmly established and most certain to continue. In seeking solutions to the problems of ground combat, scientists supporting the Army have turned more and more to a new research tool, the war game. In endeavors to perfect war gaming as a research tool, many types of game have been developed, and increasing use is being made of computers.

War gaming as a research tool to study ground combat is less than 15 years old and is still in a very early stage of development. The state of the art as it exists today can be attributed primarily to the efforts of the civilian contract agencies supporting the Army. War gaming has not fulfilled initial expectations as a research tool, primarily because of inability to quantify specifically the many factors that contribute to or affect the combat effectiveness of ground units. As a result, war gaming has not been able to produce finite results, only indicators and insights. The uncertainties of war gaming have limited the time and investment that has been put into its development. In the past the results have suffered from lack of sufficient time and personnel to develop models and analyze data and from too few repetitions. Only in the last two years has the Army made an effort to coordinate its war game programs.

In spite of the uncertainties, war gaming has grown to the point that interest in it threatens to become a fad. At the present time, new concepts and ideas have little status unless they have been war gamed. Even though they produce no finite results, war games do produce information of sufficient value to warrant its consideration in arriving at decisions. The value of war gaming is to be found in those factors which have been responsible for its increased use, the world scientific and technological revolution, U.S. worldwide commitments, and the adoption of systems analysis by the Department of Defense. War gaming is one of the best tools with which to study proposed weapons systems and assist in making decisions as to those that should be developed. Further, it is an excellent first step to field testing, and it is one of the best means of evaluating weapons systems that cannot be tested in the environment of their employment. It has proven to be a very beneficial and economical means of testing our plans to meet worldwide commitments. War gaming data has been accepted as a part of systems analysis studies which are required to support quantitatively all Army recommendations to the Department of Defense.

The extent to which war gaming can be developed as a research tool is yet to be determined; however, there is every indication that it will continue to be used on a sizable scale to study the problems of ground combat. Our immediate objective should be to produce more valid data in a shorter period of time. The value of war gaming as a tool to study ground combat can be enhanced appreciably through a program to acquaint responsible individuals with the present limitations of war gaming and the need for further development, expansion of the present coordination effort into a clearing house activity to act as a source of all information on war games and to coordinate the development of war gaming, and the development of computer software for war gaming.

CHAPTER I

INTRODUCTION

War games are as old as recorded history, but only in recent years has the US Army evidenced any strong interest in their use. Surprisingly, the interest has not been generated by the military, but rather by the scientists and analysts supporting the Army.

The impact of operations research on US military operations during World War II has resulted in a continuing growth in the application of its techniques to military problems. The partnership of the military and the scientist, which was initiated during World War II, now appears to be firmly established and most certain to continue.¹ The Army alone has been spending in excess of \$10 million per year on operations research in recent years. In the quest for solutions to military problems, scientists and analysts have been turning more and more to a new research tool; that of the war game. The interest in its use threatens to become a fad; new ideas and concepts have little status until they have been gamed.²

The recent impact of war gaming is evidenced by the many publications and articles dealing with war games and the theory of war games and by the number of agencies involved in war gaming.

¹Donald W. Meals, "Trends in Military Operations Research," Operations Research, Vol. 9, Mar.-Apr. 1961, p. 257.

²Ibid., p. 254.

The Army War College Library has more than a thousand references on war games and war game theory. In excess of 90 percent of these have been published since 1953. The Army has more than 30 agencies (military and contract) using war games of one form or another.³ War gaming at the Department of the Army level alone employs the services of more than two hundred individuals and requires an expenditure of approximately \$4 million annually.

In spite of the increased emphasis on war gaming, its value, particularly as a research tool, continues to be debated.

In a broad sense war games take many forms. They range from near-realistic field maneuvers and controlled field experiments to abstractions as simple equations. Between these two extremes there are a variety of games which are variations of the two extremes and combinations of the features of both. AR 320-5 defines a war game as "a simulation, by whatever means, of a military operation involving two or more forces, conducted using rules designed to depict an actual or assumed real life situation,"⁴ and it is within this context that the term is used in this paper.

The purpose of this paper is to examine the application of war gaming to ground combat, with particular emphasis on its use as a research tool by the US Army.

³US Army Strategy and Tactics Analysis Group, Directory of Organizations and Activities Engaged or Interested in War Gaming, pp. 4-12.

⁴US Dept of the Army, Army Regulations 320-5, p. 438.

CHAPTER II

HISTORICAL BACKGROUND

The exact origin of war gaming is not known. The ancient game of chess, a game of strategy, probably invented by an Oriental soldier, is believed to be the oldest form of war game.¹ From their earliest conception to 1823, war games remained basically forms of chess and were played primarily for relaxation. The evolution of the game from one of relaxation to one of military value was brought about primarily through the invention of "Kriegspiel" by the German military. The game was first moved from the chessboard by Herr von Reinwitz, the Prussian War Counselor at Breslau, when he transferred it to a sand table in 1811. However, it is his son, von Reinwitz, Jr., a lieutenant in the Prussian Guard Artillery, who is credited with adapting the war game to actual military operations when, in 1824, he transferred the game to map-like charts. Although transferred from the board to a chart, war games continued to be played like chess, under a rigid set of rules, and their primary military value lay in their use for training junior leaders.²

Even with the interest of such great Prussian military leaders as Prince William and Count von Moltke, it became apparent that war games would never achieve popularity unless the rigid

¹Johns Hopkins University, Operations Research Office, History and Bibliography of War Gaming, p. 2.

²Ibid., pp. 3-9.

rules were relaxed. Accordingly, in 1876 an eminent instructor in the German Army, Colonel von Verdy du Vernois, led a movement for a much freer conduct of the game. As a result there developed two schools of thought on the conduct of war games; one favoring the rigid game with its chess-like rules, and the other favoring a free game that had only a limited number of rules and was umpired by experienced officers. With the advent of the free approach, war gaming flourished remarkably and spread to many countries. By 1900 war gaming had been adopted by Austria, Hungary, Russia, France, England, Italy, Turkey, Japan, and the United States.³ The spread of war gaming is attributed to the military success of the Prussians over the Austrians in 1866 and over France in 1870-71.

At the turn of the century, war gaming still was used primarily for training junior officers. However, at this time, with the Germans again leading the way, it began to be used as a means of testing operational concepts. Following World War I, war gaming became an essential part of the German Army training program, principally because of the restrictions placed on the size of the German Army and the amount of funds available after their defeat. Since they were unable to conduct maneuvers to any practical extent, they turned to war games as a means of training leaders and testing plans. The Germans made extensive use of war games to test their plans for both fronts during World War II and attributed their

³J. K. Hjalmarson, "The Development of War Games," Canadian Army Journal, Vol. XV, Winter 1961, pp. 7-8.

initial successes to the knowledge gained from these games.⁴ They found that their operations in 1940 and 1941, against both the western allies and Russia, had been so well rehearsed through war games that each commander down to company level was thoroughly familiar with his initial mission, the nature of the enemy forces facing him, and the difficulties he likely would encounter.⁵

The use of war games to develop operational plans also was popular with the Japanese. In 1940 they undertook to program the nation's future courses of action by a series of war games. These games resulted in a plan that started with the attack on Pearl Harbor in 1941. Further games conducted at the War College in Tokyo resulted in the carefully planned schedule for the occupation of Malaya, Burma, the Dutch East Indies, the Solomons, and the Central Pacific Islands.⁶

Although both these great powers lost the war, it is significant to note the successes they achieved with plans founded on lessons learned from war gaming.⁷

Prior to World War II the US Army did little to develop war gaming. Although a considerable amount of training and instruction was accomplished by means of map exercises, emphasis was on command post exercises and field maneuvers. It took World War II and operations research to give emphasis to war gaming in the US Army.

⁴Johns Hopkins University, op. cit., pp. 18-20.

⁵Hjalmarson, op. cit., pp. 9-10.

⁶Ibid., p. 9.

⁷Ibid.

Since the introduction of operations research techniques into decisionmaking processes, war games have provided many of the models from which analysts have drawn data to study weapons systems, organizations, and operational concepts.

The origin of the use of war games as a research tool is somewhat indefinite. Ellis A. Johnson, former Director of the Operations Research Office, Johns Hopkins University, alleges Moltke used war games as a research tool in the 1860's to develop tactics to maximize the effectiveness of the breech-loading rifle.⁸ John Young, also of the Operations Research Office, credits theories advanced in 1927 by John von Neuman, a professor at Princeton University, with reviving interest in rigid games and providing the basis used by others to turn the war game into an operations research tool.⁹ Von Neuman and Oskar Morganstern published an extensive account of game theories in their book Theory of Games and Economics Behavior in 1944. While von Neuman's theories may have provided the incentives which led to the adoption of war gaming as an operations research tool, war games as used today have little in common with game theory.¹⁰

Although the British were the first to introduce operations research techniques into the decisionmaking process, the United

⁸Ellis A. Johnson, The History and Future of War Gaming in Operations Research, p. 2.

⁹Johns Hopkins University, op. cit., pp. 23-24.

¹⁰Robert G. Hendrichson, "Pros and Cons of War Gaming and Simulation," First War Gaming Symposium Proceedings, 30 Nov. 1961, p. 68.

States has led the way in developing war games as a tool to evaluate new weapons systems, new organizations, and new operational concepts.

CHAPTER III

CLASSIFICATION OF WAR GAMES

In efforts to perfect war gaming and to adapt it to the many problems of ground combat, a number of different types of games have been developed. To date, no single type of game has been devised that will solve all problems. The various types of games and methods of play provide an insight into war gaming and its complexities. The most common classifications are in terms of usage as brought out in chapter II. In this regard, games are classified as training games, operational games, or research games. Regardless of the use of a game, it can be further classified as to method of play, player participation, and scope.

CLASSICAL METHODS OF PLAY

One of the earliest classifications of methods of play was that of "free" games and "rigid" games. A completely free game is one in which all player decisions and controller assessments are based entirely on the subjective judgments of the personnel involved. A completely rigid game, on the other hand, is one in which all decisions and assessments are made on the basis of an explicit set of rules. Modern research games tend to fall more or less in the middle of the scale.¹ The completely rigid game

¹Martin N. Chase, "Basic War Gaming Terms and Concepts," Second War Gaming Symposium Proceedings, 16-17 Mar. 1964, p. 22.

is used in seeking the solutions to some problems, specifically those with only a limited number of variables and where realistic mathematical models can be developed.

As a research tool, the free game is very limited; however, it continues to be a good tool for the training.² The free aspects of present day games normally are found in the decisionmaking processes of the opposing sides.

MODERN METHODS OF PLAY

The four most common methods of play in war gaming today are manual (hand played), computer assisted, completely simulated, and computerized. In manual games the opposing forces and the umpires or control elements are represented by human players who make all decisions and do the necessary bookkeeping. While the players have the freedom of decision, the control team assesses the interactions in accordance with a set of rules and applies subjective judgment only in those areas not covered by the rules.³ The basics of the manual game have changed very little over the years.⁴ However, it has been modernized in technique and design to speed up play and to provide the types of data necessary to make an

²Ellis A. Johnson, The History and Future of War Games in Operations Research, p. 20.

³W. L. Archer, "The Technique of Modern War Gaming," Canadian Army Journal, Vol. XV, Fall 1961, pp. 16-17.

⁴Arthur W. Pennington, "History and Classification of War Games," First War Gaming Symposium Proceedings, 30 Nov. 1961, p. 2.

evaluation of the problems under study. Although computers are being used increasingly in war gaming, the manual game continues to be of value. Many headquarters and agencies involved in war gaming cannot justify the cost of a computer. Further, manual games are essential for development of computerized and computer assisted models.⁵

A computer assisted game is very similar to a manual game. The basic difference being that some portions of the routine operations (usually bookkeeping and casualty and damage assessments) are done by a computer. The use of the computer in this manner results in an appreciable saving in time and improved accuracy in the bookkeeping.⁶

A completely simulated game is normally conducted with a computer, and it proceeds without interruptions since the necessary decisionmaking has been incorporated into the game program. It is completely rigid in every respect.⁷ Such games can be conducted manually; however, by design they are meant for the computer, which can provide the large number of repetitions necessary to make the results meaningful.

In the computerized game all computations and assessments are made by the computer as in a computer assisted game. It differs in that the computer selects appropriate programmed tactical decisions

⁵Harold F. Brown, Orientation on War Gaming, p. 13.

⁶Alfred W. DeQuoy, "Operational War Gaming," Armor, Vol. LXXII, Sep.-Oct. 1963, p.35.

⁷Ibid.

for a predetermined level of command, and the players make decisions and exercise operational control above that level. The computerized game is in part a complete simulation.⁸

Games that lend themselves to rigid play and complete simulation are those in which machines are dominant. Tank-antitank games and air defense games are examples. More complex games involving a variety of units and weapons are more manageable and useful at this time by using an element of free play.

The computer has had the greatest impact on war gaming of any recent development. Its contributions, advantages, and disadvantages are discussed in greater detail in chapter V.

PLAYER PARTICIPATION

Other descriptive terms used to identify characteristics of war games relate to the manner in which the players participate. Among such classifications are closed games, open games, and one-sided games. An open game is one in which all players are completely aware of all actions taking place. Such games generally are played in a single room with a map or terrain table display. A closed game, on the other hand, is one in which the opposing players are completely isolated from each other, and they operate with the information and intelligence supplied to them by control elements (men or computers) which determine the results of the actions of

⁸Brown, op. cit., p. 9.

play.⁹ In a one-sided game the controller usually represents the enemy as well as the control element. Such games are most useful for training and for studying certain aspects of combat operations such as logistics.

SCOPE

As a matter of convenience, war games frequently are classified by the scope of the problem to which they are addressed in addition to their use, method of play, and player participation.¹⁰ Such classifications are logistic, intelligence, tank-antitank, air defense, battalion, division, and theater games. These classifications normally are used with others to provide a complete description of the type of game being referenced. As an example, one type of game might be classified as a two-sided, closed, manual, division, logistic game.

MISCELLANEOUS CLASSIFICATIONS

Other classifications which do not fall into the aforementioned categories are quick games, minigames, and static analyses. Quick games are exactly what the name implies. They are used generally to study certain higher level problems and are accelerated by aggregating the actions of the lower echelons. Aggregation is accomplished by extending the time steps and computing casualties,

⁹Chase, op. cit., p. 22.

¹⁰Pennington, op. cit., p. 5.

damages, and movements at the larger unit level. In a theater level game, the time step might be as great as 24 hours or even more if no critical event occurs, and all casualties, movements, and damages assessed at the division level.¹¹ Quick games are possible only if the gamers possess good detailed data on which to base their aggregations at the higher levels. Such data generally comes from the play of detailed games with the same types of units in a similar environment.

Inasmuch as it is not dynamic, a static analysis is not really a war game. However, it generally is developed from a war game situation or from a realistic deployment of forces on a map. The technique permits the detailed study of the circumstances of a critical event during a war game or such items as the effectiveness of various weapon systems deployed in different manners.¹²

Minigames are low level games with a high level of resolution. In these games certain aspects of small unit actions are studied in great detail. In addition to providing information and data which facilitate development of small unit organizational and operational concepts, the data derived from these games is used to aggregate small unit actions in higher level games.¹³

¹¹L. J. Dondero, Personal interview, 17 Nov. 1965.

¹²Chase, op. cit., p. 23.

¹³Martin N. Chase, Personal interview, 18 Nov. 1965.

CHAPTER IV

DEVELOPMENT

By the end of World War II, the Army Air Force had over four hundred people engaged in operations research activities.¹ Similarly, the Navy's operations research effort had increased from a seven man study of mine warfare problems to a seventy-three man task force of experts.² However, the Army apparently had failed to recognize the value of the application of operations research techniques to ground combat and, as a result, had made no effort to apply this new science to the problems of land warfare.

Profiting from their experience in World War II, both the Air Force and the Navy foresaw the need for an operations research capability in the postwar years. The Air Force entered into a contract with the Douglas Aircraft Corporation to establish project RAND (the name being derived from the words Research and Development). In 1948 project RAND became the RAND Corporation, a non-profit organization, which worked under contract with the Air Force to engage in specific studies.

The Navy retained its World War II Operations Research Group until 1947, when it entered into a research contract with the

¹US Air Force, Operations Analysis in World War II, pp. 1-5.

²Jacinto Steinhardt, "Role of Operations Research in the Navy," US Naval Institute Proceedings, Vol. 72, May 1964, p. 655.

Massachusetts Institute of Technology. With this contract the Operations Research Group became the Operations Evaluation Group.

Following World War II, the Army monitored the development of civilian operations research groups working with the Air Force and Navy and came to the conclusion there was a need for a similar organization to support the Army. As a result the Army entered into a contract with Johns Hopkins University, and on 28 September 1948 the General Research Office was established at Fort McNair, Washington, D.C. In December 1948 the name was changed to the Operations Research Office (ORO), and shortly thereafter it moved to Chevy Chase, Maryland.

Personnel of ORO foresaw possibilities in war gaming quite early, and their interest began in earnest in 1950.³ Initial efforts were experimental in nature; however, from these first efforts ORO saw what it believed to be a research tool of significant potential. In 1953 ORO established the Combat Operations Research Group (CORG) as a division of the Office of the Deputy Chief of Staff for Combat Developments, USCONARC.⁴ CORG had two subdivisions, War Gaming and Field Experiments. ORO operated CORG and supplied the scientists and analysts for the agency.

From this rather inauspicious beginning, modern war gaming of ground combat has grown into the multimillion dollar venture cited in chapter I. While many agencies and organizations are

³Ellis A. Johnson, The History and Future of War Gaming in Operations Research, p. 16.

⁴Martin N. Chase, Letter to the author, 7 Oct. 1965.

or have been engaged in war gaming, its development as a research tool for the study of ground combat can be attributed primarily to three agencies:

1. Combat Operations Research Group.
2. Operations Research Office, now known as the Research Analysis Corporation.
3. United States Army Strategy and Tactics Analysis Group.

COMBAT OPERATIONS RESEARCH GROUP

The first war game undertaken by CORG was Exercise Cheeseburger in July 1953. This was a regimental combat team game used to develop methodology and test the feasibility of manual war gaming as a research tool.

During 1954 and 1955 CORG conducted three corps level games to test operational concepts, and it war gamed Exercise Sagebrush to evaluate the feasibility of the exercise plan.

In November 1955 the operation of CORG was transferred from ORO to Technical Operations Incorporated of Cambridge, Massachusetts. It was at this time that the expression SYNTAC was born. SYNTAC is an acronym for SYNthetic TACTics which was applied to CORG's two-sided closed manual war game being used to evaluate future operational and organizational concepts.⁵

⁵Ibid.

CORG's early efforts at war gaming larger scale exercises pointed out a need for more detailed study of the lower echelons of ground combat to aid in the assessment of small unit actions and the development of methodology. This requirement was partially fulfilled by special studies and small unit war games, and in 1956 the rules and procedures developed up to that time were published in a war gaming manual. No formal distribution was made of the first manual; however, it was revised and updated in 1957 and was published and distributed as the USCONARC War Gaming Handbook. The rules and procedures were again updated and revised in 1961 and were published as USCONARC Pamphlet 70-5. This publication represents a very comprehensive and detailed description of the methods and procedures used in the SYNTAC war game. There has been no revision since 1961, but new rules, methods, and analytical and assessment techniques are presently being documented. While the methodology has frequently been different, the rules of play developed and documented by CORG have been used at least as a guide for the majority of the manual war games conducted by various Army units and educational institutions. As late as 1950, the extent of the Department of the Army's publications on war gaming was a simple six-page directive which related the conduct of a war game to those rules in umpire manuals used for the conduct of a field exercise.⁶

⁶US Dept of the Army General Staff, G3, The Organization and Conduct of War Games, pp. 1-6.

In addition to updating its rules of play, CORG developed a war gaming display system that improved the display and transmission of game deployments and intelligence, and it integrated the computer into its games in the period 1958 to 1960. These improvements provided a more detailed game evaluation in a shorter period of time.

In 1962 CORG became responsive to the newly activated Combat Developments Command, and it physically moved from Fort Monroe, Virginia, to Fort Belvoir, Virginia. Following this move it devoted considerable effort to a number of small unit high resolution games to support special studies. In addition to providing information for the special studies, these games supplied data which provided for more realistic aggregation at higher levels in larger unit war games.

CORG's major contribution to the development of modern war gaming has been improvement in the techniques of two-sided, manual, closed games that use free aspects of decisionmaking.

OPERATIONS RESEARCH OFFICE

Concurrent with the war gaming effort being carried out by CORG, ORO was conducting war games at its home office in Chevy Chase, Maryland. However, ORO's early efforts were directed to development of methodology, specifically the use of the computer, and to special models to study certain aspects of ground combat. Among their early efforts were a computer simulation for the study

of small unit tactics (this game is still being used today); a global war game to study strategic problems; a game to study intelligence functions, particularly target acquisition and surveillance; and a strategic game incorporating both political and military considerations.⁷

In 1961 the Department of the Army terminated its contract with Johns Hopkins University and negotiated a contract with the personnel of the Operations Research Office, which reorganized into a nonprofit organization known as the Research Analysis Corporation (RAC). While the names are different, RAC is basically a continuation of ORO. Currently, its offices are in McLean, Virginia.

From 1950 through 1962 well over 50 percent of ORO's (RAC's) war gaming effort was spent in development of models to study the various aspects of ground combat. While CORG must be credited with a significant contribution to manual war gaming and rules of play, ORO (RAC) must be credited with the greatest overall contribution to the war gaming of ground combat and, more particularly, with the development of models. Its efforts have resulted in three very sophisticated complementary models that are adaptable to a large variety of problems: CARMONETTE is a completely simulated small-unit ground combat model that has been programmed for a large, high speed, digital computer; TACSPIEL is a computer-assisted, division level game with a level of resolution normally at the

⁷L. J. Dondero, Letter to the author, 28 Sept. 1965.

company; THEATERSPIEL is a computer-assisted theater level game that is resolved at division level.

RAC is presently expending a major portion of its war gaming effort in evaluation of organizational and operational concepts.

The work carried out by RAC in war gaming of ground combat has been very complementary to that of CORG and has seldom been in competition with it. While CORG was perfecting manual techniques for the study of tactical situations, RAC was perfecting computer techniques for all types of games and was extending the use of manual play into areas other than those being studied by CORG.

STRATEGY AND TACTICS ANALYSIS GROUP

RAC and CORG are civilian agencies which operate respectively under contracts to the Office of the Chief of Research and Development and the Combat Developments Command of the Department of the Army.

In the late 1950's it became apparent there existed a requirement for an analytical capability within the Department of the Army which exceeded that available within RAC and CORG. Rather than expand either or both of these organizations, it was decided to activate an in-house capability which would be operated by military personnel and would be responsive directly to the Deputy Chief of Staff for Military Operations. To fulfill this requirement, the Strategy and Tactics Analysis Group (STAG) was activated as a Class II Field Activity at Bethesda, Maryland, in 1960. The mission assigned to STAG was to support Department of the Army

operational planning and evaluation activities by war gaming and allied techniques.⁸ The first specific task assigned to STAG was to develop a land combat war gaming model for testing Army plans. To the extent feasible, the model was to be developed for application to a large-scale computer.⁹

The activation of STAG provided a fresh look at the work which had been done by CORG, RAC, and other agencies; and the result has been the development of the most advanced war game to date.¹⁰ The game has been adapted to the computer wherever possible, and, additionally, it has a display system as modern and efficient as the computer itself.

OTHER AGENCIES

To say that CORG, RAC, and STAG have been wholly responsible for the development of the war gaming of ground combat would be a gross inaccuracy. The state of the art as it exists today could never have been reached without the cooperation and assistance of other agencies, both within and outside the Army.

There always has been cooperation among all agencies involved in war gaming in the United States Army, Navy, and Air Force. Additionally, this cooperation has been extended to include war gaming agencies of the Canadian and British military forces. This

⁸ Alfred W. DeQuoy, "Operational War Gaming," Armor, Vol. LXXII Sep.-Oct. 1963, p. 34.

⁹Ibid., p. 37.

¹⁰Ibid., p. 39.

interchange has contributed materially not only to the development of techniques for the war gaming of ground combat but to all aspects of war gaming.

Field commands, branch schools, and combat development agencies within the Army have provided large amounts of the technical information which have been used to develop the specific rules of play. Civilian contractors working for Army agencies have used war gaming to study selected aspects of ground combat, such as chemical warfare, communications, air defense, and electronic warfare. Their work has contributed to the development of techniques in these specific areas.

The US Marine Corps is leading the way in the use of war gaming to study the onshore aspects of amphibious operations. It has developed a Landing Force War Game which is conducted by the War Games Division of the Landing Force Development Center at Quantico, Virginia.¹¹ In addition to a number of studies of various aspects of amphibious warfare, it has developed a Landing Force War Game Rules Book.¹²

¹¹Edgar F. Musgrove, "No Game," Marine Corps Gazette, Vol. 49, Aug. 1965, pp. 53-56.

¹²United States Army Strategy and Tactics Analysis Group, Directory of Organizations and Activities Engaged or Interested in War Gaming, p. 57.

CHAPTER V

PROBLEMS AND LIMITATIONS

As a form of experimental research, war gaming must be considered to be still in a very early stage of development. This does not imply there is no payoff in war gaming today.¹ As an operational research tool, modern war gaming of ground combat in the United States is less than 15 years old. Its development to date has been evolutionary, not forced, and can be attributed primarily to the efforts of a limited number of scientists and analysts, especially those of RAC and CORG, who have had faith in its usefulness and have accepted its development as a challenge.

From the outset research gaming has been beset with frustrations and problems that would have destroyed many programs in their infancy. It has been attacked often by nongamers as lacking rigor, relevance, reliability, and results.² During the Second War Gaming Symposium conducted at Washington, D.C., on 16 and 17 March 1964, the majority of the speakers emphasized the limitations of war gaming.

RULES OF PLAY

One of the more difficult problems encountered by war gamers has been the development of rules with which to assess the interactions

¹W. L. Archer, "The Techniques of Modern War Gaming," Canadian Army Journal, Vol. XV, Fall 1961, p. 21.

²William P. Murden, "The Public Image of War Gaming," Second War Gaming Symposium Proceedings, 16-17 Mar. 1964, p. 161.

between forces. Originally, data for rules came from the historical records of World War II and, where these did not exist, from the combined experience and knowledge of seasoned combat commanders.³ Constant efforts have been made to update the rules through additional research; the use of other operational analysis techniques; and new data obtained from weapons tests, field experiments, and maneuvers. In spite of these efforts, current rules leave much to be desired.

The rules of a war game are inputs and, as such, influence the outputs or results of the game. The validity of any game is dependent upon the validity of the inputs.

The development of rules requires consideration of those factors which contribute to and affect a unit's combat effectiveness. The principal factors which must be considered are firepower; mobility; command and control; logistics; intelligence; terrain; weather; casualties; and the incommensurables of training, leadership, morale, shock, fatigue, and esprit de corps. The big problem that stands out above all others is the quantification of the factors listed above. If realistic relative numerical values could be assigned to all those factors, the problem would be solved. The qualitative values of the factors are readily recognizable; however, the interrelationships and interdependency of these factors preclude any finite quantification and many of them continue to defy any measure of quantification. The study of ground combat, by any means, is

³Archer, op. cit., p. 20.

the most difficult task which has been undertaken by the analyst. Ground combat is dominated by that poorly understood factor, man himself,⁴ and to date the evaluation of man has resisted all theories of quantification.

Certainly related to unit combat effectiveness is the intelligence problem, which stands out alone as a perplexing one. Just what are a commander's chances of physically locating and identifying an enemy unit, and to what degree are his chances a function of time? A commander's course of action always is governed by his knowledge of the enemy. Without realistic inputs of intelligence data into a war game, the course of a game and its results are subject to question. This problem is further complicated by a number of new types of detectors which have not been tested in combat. The construction of a realistic intelligence model is far more difficult than summing up the output of the physical detector system, and even this is rarely done in a war game. In part this deficiency is offset in war games by the umpires or controllers supplying specific intelligence to both sides rather than bits of information to be evaluated by a staff and developed into intelligence.⁵

The lethal areas and hit probabilities used to express the effectiveness of weapons have been derived, in a large part, from field tests and are generally good. However, lethal areas and hit

⁴Richard E. Zimmerman, "A Critical Review of the Gaming of Ground Combat," Proceedings for the Third Symposium of the East Coast War Games Council, 27-28 Feb. 1964, p. 1.

⁵Ibid., p. 3.

probabilities can vary possibly as much as a factor of 10,⁶ depending on the posture of the target and the nature of the terrain. While it has been possible to develop data related to target posture through experimentation, the variations in terrain coupled with the variations in target posture that occur during the course of an action preclude realistic assessment of casualties in a war game which is not influenced to some degree by the subjective judgment of the control element or those who design it. Another of the imponderables is the effect of neutralization fire. Just how much effect does it have on the outcome of an engagement, and how does one measure it and interject it into a war game?⁷

Staff planning and decisionmaking are probably the most realistic aspects of a war game. However, other aspects of command and control such as communications and execution are treated rather lightly. The outcome of a game is seldom affected by a lack of friendly information, misinterpreted orders, or a breakdown in communications as is a real engagement. While failure to interject these items realistically into a war game detracts to some degree from realism, they do not necessarily devalue the game. To a large degree these factors are a matter of training. Exceptions are communications equipment and communications procedures that can be evaluated and perfected far better during the course of field training exercises than with war games.

⁶Ibid., p. 3.

⁷Ibid., p. 4.

War gamers have not been able to establish satisfactory quantitative measures for such factors as training, leadership, morale, esprit de corps, shock, and fatigue.⁸ While it is accepted that these factors have frequently been most important in battles of past wars, the tendency has been to ignore them in war gaming and to concentrate on those factors that appear to be subject to some measure of quantification.

Historical records have provided some data on rates of advance that can be related to force ratios and organic mobility. While new hardware and operational concepts are rendering much of the data obsolete, field tests and experiments make it possible to keep it updated with reasonably realistic values. The aspect of mobility which resists quantification is its contributions to maneuver. The qualitative value of maneuver, like that of neutralizing and suppressing fire, is very recognizable, but it is most difficult to quantify this contribution to success in battle.

It is well known that units become less effective as they suffer casualties in men and equipment. However, little is known of the rate at which to degrade a unit's effectiveness as a result of casualties, and only a limited amount of information is available concerning the percentage of casualties a unit can suffer within a given time frame before it becomes ineffective.⁹

Two variables that have a direct bearing on a unit's combat effectiveness are weather and terrain. Although historical records

⁸Harold F. Brown, Orientation on War Gaming, pp. 20-21.

⁹Zimmerman, op. cit., pp. 5-6.

and experimentation have assisted in supplying some data on these variables, the extremes of their effects are so great that they are deserving of special consideration and study. It has been learned that the results of a game played on a map of Europe cannot be accepted as applicable for other areas such as Africa or the Far East.¹⁰

Logistic war games are as realistic in methods of play as any other type. The big problem is in one major input, the validity of the requirements. If one could have faith in the requirements generated by the interactions of the combat elements in a war game, then logistic games could contribute much to the development of logistic concepts. In spite of this question, alternatives can be evaluated with war games by varying the requirements.

The problem of quantifying the various factors that contribute to or affect a unit's combat effectiveness have been recognized by the Army and are being studied at the present time. The Combat Developments Command Institute of Advanced Studies currently is devoting considerable effort to this problem.

Data acquired from actual combat operations is by far the best for development of rules of play; however, limited actions such as those occurring in Vietnam do not fill the need completely. Scientists and analysts supporting the Army's war gaming effort

¹⁰Research Analysis Corporation, Some Basic Problems in War Gaming, pp. 9-10.

consider field tests and experiments as the best means of filling the void and providing data in periods of peace. To date the development of war games has received only limited support from field tests and experiments.¹¹

MODELS AND METHODS OF PLAY

One of the first steps in war gaming is to develop a game model. A model may be defined as "A representation of states, objects, or events in the real world which is idealized in so far as only selected properties of reality are represented and which is therefore less complicated than reality."¹² War game models are composed of a large number of submodels, which insofar as is practical are based on proven mathematical techniques capable of assessing the interactions between forces and the factors that affect the combat effectiveness of a unit. Rules, methods of play, and analytical techniques are parts of a model. Simple models are practical and easy to manage but are seldom realistic. Highly realistic models tend to become impractical. The task of the war gamer is to design a model that is manageable and reasonably realistic. His objective is to develop the simplest model that will effectively evaluate the problem under study. The search for best solutions has contributed to the many classifications described in chapter III.

¹¹Ellis A. Johnson, The History and Future of War Gaming in Operations Research, p. 21.

¹²Brown, op. cit., p. 5.

The study of ground combat by war gaming is generally one of a high level of optimization. Mr. Richard E. Zimmerman of the Research Analysis Corporation describes it as ". . . war gaming is a part of the still pioneering effort to study the whole problem, not just a part of it. . . ."13 Some aspects of ground combat do lend themselves to suboptimization, study by parts. No feature of ground combat can be completely factored from the remainder of the problem, only more or less so. In designing a game model, war gamers must determine whether the problem lends itself to suboptimization and at what level to suboptimize if the results are to be useful. In many cases suboptimization is exactly what is needed; however, suboptimization at too low a level is likely to place constant values on the very elements which have been described as "galloping variables."14 Even the most limited tactical problems involve such a large range of variables that they defy solution by combinations of successive suboptimizations.15 Ground combat rests heavily on the effects of many variables working together and is unique in that the whole frequently appears to be worth more than the sum of the parts. Perhaps one of the most simple examples is the tank-infantry team, which is worth considerably more than the two elements operating independently.

13Zimmerman, op. cit., p. 8.

14Ellis A. Johnson as quoted by Walter E. Cushen, "War Games and Operations Research," Philosophy of Science, Vol. 22, Oct. 1955, p. 311.

15Walter E. Cushen, "War Games and Operations Research," Philosophy of Science, Vol. 22, Oct. 1955, p. 311.

Problems that can be suboptimized at a low level frequently lend themselves to completely simulated methods of play. The speed with which a computer can play a game permits a very detailed study of a small segment of the problem area, by holding the remaining elements constant and varying the factors within the selected segment in successive repetitions of the game.

Because ground combat does not lend itself to suboptimization at low levels, war gamers are faced with the problem of designing models to handle the many variables which invalidate solutions by suboptimization. The most common approach to keep higher level games from becoming smothered in details is to use the technique of aggregation, a simplifying process of treating groups of individuals as a unit or a number of individual happenings as a series of single groups of happenings.¹⁶ In a division level game the smallest unit played might be the battalion, whereas in a theater level game the smallest unit might be the division. To some war gamers the importance of aggregation in ground combat cannot be stressed too highly.¹⁷ Aggregation has the effect of simplifying or discarding details, which is always subject to question. One experienced gamer believes that it is asking too much for a simple rule to approximate the coordinated effect of fire and maneuver.¹⁸ The key to successful aggregation lies in the development of valid rules. Some work has

¹⁶Research Analysis Corporation, op. cit., p. 11.

¹⁷Archer, op. cit., p. 20.

¹⁸Zimmerman, op. cit., pp. 5-6.

been done in producing models for aggregated games from the results of detailed games; however, this technique needs considerably more study and documentation.

The methods of play described in chapter III have evolved as results of efforts to improve the techniques of war gaming. The various methods are not necessarily in competition with each other. Each type has its advantages and disadvantages.

Manual games are preferred by some, because they appear to provide the best means of comprehending the scope of a complex situation. Manual games are slow and are costly in manpower and time. The game time to real time ratio can run as high as 40 to 1.¹⁹ The time required to conduct a manual game certainly limits the number of repetitions that can be accomplished. The personnel involved in the game are among the immeasurable variables. Their ability, inability, attitudes, and knowledge gained through play of the game are reflected in the outputs.²⁰ The commonly used technique of employing a single staff to play all echelons during a war game insures a degree of integration of all plans which is seldom achieved in the field.

Completely simulated games using a computer eliminate many of the problems of manual play, but in turn, generate some new problems of their own. A computer cannot reason. It can only do what it is

¹⁹Alfred W. DeQuoy, "Operational War Gaming," Armor, Vol. LXXII, Sep.-Oct. 1963, p. 37.

²⁰Robert G. Hendrickson, "Pros and Cons of War Gaming and Simulation," First War Gaming Symposium Proceedings, 30 Nov. 1961, p. 72.

told and must be given instructions to cover every eventuality. No computer has yet been built which can be programmed for all the possible courses of action that might occur within a division during an engagement. A simple chess game with its 64 square and 32 pieces has been computed to have some 10^{40} or 10^{50} possible games.²¹ It goes without question that a division in combat has more variations than a chess game. In programing a computer for a war game, it is most important that it be provided a choice from among the most probable courses of action.

Computers are expensive and they require considerable time to program and debug. Further, they are artful concealers of errors.²² Terrain and weather, two of the most significant variables that affect ground combat, are extremely difficult to program into a computer.²³ The speed with which a computer can play a game permits a large number of repetitions. This aspect permits examination of a number of alternative courses of action, and it eliminates the possibility that the outcome of the game or the results are a matter of chance which can occur in a manual game using probabilistic rules of play. Although computer simulations eliminate many of the player weaknesses of manual games, they do not always provide the intuitive insight gained by experienced officers playing a manual game.

²¹Research Analysis Corporation, op. cit., p. 25.

²²Herman E. Adams, "Machine Played Games," First War Gaming Symposium Proceedings, 30 Nov. 1961, p. 61.

²³E. S. Maloney, "Modern War Gaming: State of the Art," Marine Corps Gazette, Vol. 44, Nov. 1960, p. MCA-12.

Computerized games and computer-assisted games appear to be outstanding compromises incorporating the best features of manual games and completely simulated games. The computer relieves the players of the time consuming tasks of looking up data, making computations, and bookkeeping. Its memory and speed make it equivalent to thousands of clerks, and its reliability greatly minimizes common human errors in calculations. It permits the military player to be left to the tasks for which he is best suited: evaluating courses of action and making decisions.²⁴ Computerized games have approached the problems of aggregation by completely simulating the lower echelons during play. However, this technique has not been extended above company level to date, and its possibilities at higher levels are yet to be determined.

ADMINISTRATIVE PROBLEMS

In addition to the limitations and problems associated with rules and methods of play, the perfection of war gaming has been hampered by a number of things which may be classed as administrative in nature. Although many of these problems are being overcome, some still linger in varying degrees.

One of the very first problems was the inability of the scientist and the military man to communicate effectively with each other. The scientist could not rationalize warfare in the same manner as the military man, and only a very few of the military

²⁴DeQuoy, op. cit., p. 37.

understood the techniques of the scientific approach. Both groups were looking for clean, clear-cut explanations, when they did not exist on either side. This situation has not been helped particularly by the parochial views of the scientists and analysts with respect to the best techniques to be used, or by the lack of understanding of the military of the need for experimentation with models to ascertain which techniques are best.

The uncertainties of war gaming have limited the time and investment that has been put into its development. In the past, war games have suffered from insufficient time and personnel usually available. Too frequently, the results have been limited by the fact that they were derived from too few situations. The requirement to meet time deadlines has on occasions precluded development of the best models and a thorough and detailed analysis of the data generated. Only in recent years has action been taken to specifically document all aspects of the models used in war games. The failure to document models fully has resulted in considerable redundancy of effort.²⁵

The current tendency to war game every new concept that is proposed has channeled a large portion of the Army's war gaming capability into the study of current problems. There is a general consensus among STAG, RAC, and CORG that too little time is being allowed for development of models, and that a greater effort is required if the state of the art is to be advanced.

²⁵DeQuoy, op. cit., p. 40.

Only in the last 2 years has the Army taken steps to coordinate its war gaming effort and provide for exchange of information among interested agencies. Prior to this action, agencies involved in war gaming were operating more or less independently. While there has been good cooperation among war gaming agencies, their independent operations have resulted in considerable duplication of effort and loss in time. Army Regulations 10-5 charges the Deputy Chief of Staff for Military Operations with the responsibility for coordination of the Department of the Army's war game program.²⁶ Action was initiated in 1964 to carry out this responsibility.²⁷ Steps taken, but not completed in all cases, are publication of a projected fiscal year work program for the major military and contractual war gaming agencies sponsored by the Department of the Army Staff and a reference file in the Army Library, as a part of the Army Study Documentation and Information Retrieval System (ASDIRS), which will include information on war games conducted since 1962 and war gaming models, techniques, and facilities. Long range objectives include coordination of war gaming model development and establishment of a war gaming language for computers.

Changing characteristics of military weapons and equipment, particularly the newer items, tend to outdate rules and models rapidly. The research effort required by war gaming agencies to stay abreast of changes is considerable. At the present time, each

²⁶US Dept of the Army, Army Regulations 10-5, p. 10.

²⁷US Dept of the Army, Deputy Chief of Staff for Military Operations, Department of the Army War Games Program, pp. 1-2.

agency conducts its own research and independently generates requests for raw data with which to update its rules and revise its models. These procedures have resulted in some redundancy in effort and duplication of requests to field commands and agencies.

War games generate excessively large amounts of data which must be analyzed in considerable detail to develop trends and indicators. To date, practically all game analysis has been done by analysts. Models can be designed and computers can be programed to analyze war game data as well as to simulate combat. The use of computers to analyze war game data should speed up the production of final reports appreciably, if the necessary techniques are perfected. Some agencies are making limited use of computers to analyze war game data; however, their use has not been exploited to the fullest by any means.

The potentialities of the computer in war gaming are enormous, and the hardware is considered adequate to the needs. The problem is computer software, which at this time leaves much to be desired.²⁸ A computer language for war gaming is badly needed, as are improved programing techniques and models for analysis of data and the games themselves. This need has been recognized, but the solution is not readily forthcoming. Failure to exercise proper coordination years ago resulted in a number of different types of computers being used by the various war gaming agencies. The differences in the computers in use complicate the problem appreciably.

²⁸Harold F. Brown, Personal interview, 17 Nov. 1965.

If the current problems and limitations of war gaming can be overcome, and improvement in many areas appears possible, some additional expenditure is going to be required. Ellis A. Johnson, former Director of ORO is of the opinion that war gaming is in need of far greater support, if it is to become a really useful research tool. He foresees a requirement for an annual expenditure of \$50 to \$100 million.²⁹

²⁹Johnson, op. cit., p. 23.

CHAPTER VI

THE QUESTION OF VALUE

In spite of its continued development and increased use, the value of war gaming as an operations research tool continues to be debated. In the mid-1950's, when war gaming was first being used as a research tool, there were high hopes for its usefulness, particularly among the scientists and analysts. Following is a quote from a paper produced by Mr. Alexander M. Mood of the RAND Corporation in 1954, which expresses some of the opinions about the prospects of war gaming at that time:

Recently, the technique of war gaming has been modified to make it a method for solving problems previously thought to be beyond analysis and answerable only by appeal to the judgment of experts. . . . More generally, gaming will for the first time give military planners a quantitative grip on the "balanced force" concept and the "military worth" concept.¹

By 1958 it had become apparent to some that war gaming did not hold the key that would unlock the door to the answers to all the problems of ground combat. Before the Fourteenth National Meeting of the Operations Research Society of America at St. Louis, Mo., on 23 October 1958, Mr. W. L. Whitson of the Operations Research Office stated: "After years of effort war gaming is still one of the most controversial topics at ORO. . . . But the benefits that can be

¹RAND Corporation, War Gaming as a Technique of Analysis, pp. 1, 11.

derived from war gaming is the most disputed aspect of this controversial subject."²

Today, there appears to be a reasonable degree of unanimity with regard to the benefits derived from war gaming. The key word is "insight." Almost without exception, recent articles on war gaming state that insight into problems is the most useful product. There is general agreement that war gaming produces few definite answers. What war gaming cannot do was very aptly expressed by Rear Admiral Clyde Van Arsdall, Jr., of the Joint Chiefs of Staff at the Second War Gaming Symposium of the Washington Operations Research Council, held at Washington, D.C., on 16-17 March 1964:

Finally, in introduction, I must tell you that I approach my subject of 'JOINT WAR GAMING' carrying a big sign which reads--'DANGER--HANDLE WITH CARE'. For war games are very sensitive to inputs and factors used, and results must NOT be used out of context or assumed as PROOF or as FACTS--which they definitely are not.³

If war gaming is incapable of producing definite answers, one certainly is justified in asking, "Why has the use of war gaming grown so rapidly in the last few years, and more particularly as a means to study ground combat, the most difficult of all areas?" War games can be likened unto one of the elements of a commander's estimate of the situation, for they are really dynamic and extremely

²W. L. Whitson, "The Growth of Operations Research in the US Army," Operations Research, Vol. 8, Nov.-Dec. 1960, p. 822.

³Clyde Van Arsdall, Jr., "Joint War Games," Second War Gaming Symposium Proceedings, 16-17 Mar. 1964, p. 119.

graphic comparisons of courses of action. They do not provide the answers; they provide only information that assists in arriving at decisions.

The value of any item is a relative thing which is established by a need, and by the worth of the item when compared to alternatives which can satisfy the need. It appears that the real value of the war gaming of ground combat can be determined by an examination of those factors which have created a need for new analytical techniques and have been responsible for the increased use of war gaming: (1) the world scientific and technological revolution, (2) the worldwide commitments of the United States, and (3) the application of scientific techniques to decisionmaking, or systems analysis.

SCIENTIFIC AND TECHNOLOGICAL REVOLUTION

While research gaming itself is a facet of the scientific and technological revolution, this has not been the reason for its growth. Today, science and technology are capable of providing new and improved weapons almost for the asking. However, modern military hardware is extremely sophisticated and expensive. Such a situation requires decisions of choice. To make the best choice it is necessary to study the advantages and disadvantages of each new item before making a decision. War gaming provides one of the best means of looking into the future, and its value in this regard

should increase as combat experiences become more and more out of date.⁴ While the environment is a synthetic one, the war game provides a means of studying proposed items of hardware in relation to all the factors that affect their performance.

The PENTANA war games conducted by CORG in 1957 contributed directly to decisions concerning weapons development at that time. A specific example was a new direct support artillery weapon which was to possess extremes in ranges. The results of the war games indicated there was no requirement for the short range characteristics of the weapon. This information assisted in arriving at a decision to discontinue development and to seek other more suitable alternatives.

New items of hardware also generate a requirement for new organizational and operational concepts that will maximize their strong points and minimize their weaknesses and, conversely, minimize the effectiveness of the use of such weapons by an enemy.

Maneuvers to test organizational and operational concepts are extremely expensive and, because of the expense, all but preclude repetitions to test alternatives. Further, it is much more difficult to assess the value of an item of drawing board hardware in a field exercise than in a war game. Simulations and data collection are much easier to achieve in a war game than in a field exercise. War gaming before field testing can provide for a more reliable and beneficial test by eliminating some of the obviously poor choices

⁴W. L. Archer, "The Technique of Modern War Gaming," Canadian Army Journal, Vol. XV, Fall 1961, p. 25.

and by pointing out areas to be observed with particular interest during the test. The Army's Combat Development Experimentation Center at Fort Ord, California, war games many of its experiments on a large scale terrain model before conducting them in the field. The war games enable the planners, scientific personnel, and teams conducting the experiments to examine the experiments in detail and to assure that they are carried out in a way that will provide the information needed to make proper evaluations.⁵

War gaming provides a best first step in evaluating new organizational and operational concepts. Exercise Sagebrush, a field test which was conducted in November 1955, involved 100,000 troops and cost approximately \$26 million. The exercise was war gamed by CORG during the period July-October 1955 with a team of 23 officers and scientists. The war game provided timely warning concerning problems that were likely to occur. Upon conclusion of the exercise, the Director had high praise of the assistance rendered and stated that future field exercises should not be undertaken until they had been thoroughly war gamed to assure that objectives would be achieved.⁶

War games also provide one of the better means of evaluating weapons systems that cannot be tested in their normal environment

⁵US Army Strategy and Tactics Analysis Group, Directory of Organizations and Activities Engaged or Interested in War Gaming, p. 33-34.

⁶Gordon B. Rogers, "Battles without Bloodshed," Army Information Digest, Vol. 15, Dec. 1960, p. 35.

of employment, such as air defense systems around cities. They are also ideal for the study of weapons systems that cannot be used in field tests because of expense or other reasons. New types of nuclear weapons, which may be developed in the future, are examples that fit into this latter category.

WORLDWIDE COMMITMENTS

As the leader of the free world, the United States has entered into commitments that are global. As a result, we now have military commitments in areas where we have had little or no experience. Further, we must plan for military operations in areas where we are precluded from making any detailed physical reconnaissance. To further aggravate this problem, potential enemies are refining their techniques of unconventional warfare.

To cope successfully with the problems of our worldwide commitments, we must be able to deliver proper numbers and types of units, trained in the proper operational concepts, and with the proper plans to the right place in a timely fashion. In addition, we must be prepared to support the committed units. The range of the possibilities is such that we must be prepared to fight insurgency actions, conventional wars (large and small), and all types of nuclear wars in numerous areas. The magnitude of the problem almost defies study by any means other than war gaming. Although war games cannot provide correct detailed solutions to the many possibilities of our commitments, they can provide indicators of problems yet to be solved and the feasibility of operations plans. The

importance of war gaming in this role is borne out by the fact that the first task assigned to STAG was to develop a land combat model for testing Army plans.⁷ In addition, CINCSTRIKE and CINCPAC, the two unified commanders with the largest geographical areas of responsibility, have staff personnel who are specifically allotted for and organized into units that have primary missions of war gaming.⁸

SYSTEMS ANALYSIS

Introduction of the application of operations research techniques to military problems during World War II was the beginning of the end of the traditional methods of decisionmaking. Systems analysis, like research gaming, is a facet of the scientific and technological revolution. Its adoption by the Department of Defense as a primary consideration in arriving at decisions has required the Army to develop its own skills in this field and to seek ways and means of supporting its recommendations quantitatively. Although the results of war games alone are not generally considered adequate to support a specific recommendation, they can be and are used to confirm and support other forms of analysis.

Of late there has been a sharp increase in the use of war games to support systems analysis studies. There is every indication

⁷Alfred W. DeQuoy, "Operational War Gaming," Armor, Vol. LXXII, Sep.-Oct. 1963, p. 37.

⁸Van Arsdall, op. cit., p. 119.

that this trend will continue, and the value of games should be enhanced appreciably as techniques and rules are improved. The systems analysis study of the air assault division is a recent example which was supported by war gaming data. One technique of cost effectiveness is the war gaming of equal cost units. This technique involves the war gaming of two corps or armies of different composition, but of equal cost, against the same enemy force in the same situation to determine which is more effective.

SIDE VALUES

Although the art of war gaming as it exists today has been developed primarily as a research tool, better techniques have provided field commanders and educational institutions with vastly improved and more realistic training techniques and means of testing their operational plans.

Practically all training games are manual games. STAG, however, recently conducted an experimental training exercise with its computerized game which was highly successful. The players were from the 28th Infantry Division, Pennsylvania National Guard.⁹ The computerized game appears to have great potential as a training device. It provides a highly realistic game with a real time to game time ratio of one to one. Although field commanders and Army schools may not be able to afford computerized war games for some

⁹Harold F. Brown, Orientation on War Gaming, p. 15.

time, communications facilities permit units or personnel to remain at their home stations and conduct a war game with STAG's equipment.

A number of overseas commands without organic war gaming establishments are now making use of war games to train personnel and test their operational plans. The 7th United States Army in Germany and the 8th United States Army in Korea are two major overseas commands which are making use of modern war gaming techniques.¹⁰

¹⁰US Army Strategy and Tactics Analysis Group, op. cit., p. 29-30.

CHAPTER VII

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

The development of modern war gaming of ground combat can be attributed primarily to the efforts of the civilian scientists and analysts supporting the Army's operations research effort. The increase in its use to test operational plans and for training can be attributed to our global commitments and the improved techniques evolved as a result of endeavors to develop war gaming as a research tool. The increase in the use of war gaming to study ground combat can be attributed to the need for new analytical techniques to evaluate new and proposed weapons systems, organizations, and operational concepts and to support Department of the Army recommendations to the Department of Defense.

In spite of its increased use, war gaming as a research tool is still in its early stages of development. At the present time, its limitations are so numerous that results must be evaluated in light of the assumptions made and the rules and techniques used. At best war games can provide no more than indicators and insights. The results cannot be accepted as proof or facts; however, the information produced by war games does possess sufficient validity to warrant consideration in arriving at decisions.

The development of modern war gaming has been an evolutionary process and has been hampered by the lack of data to develop rules,

the lack of time and support necessary to develop more realistic and useful models, and the inability of the military and the scientists to communicate effectively with each other. Further, there has been little effort to coordinate the development of war gaming. In spite of good cooperation among agencies involved in war gaming, there has been an excessive amount of duplication. Current efforts to coordinate the Department of the Army's war game program represent an excellent first step to an action which has long been needed.

Our immediate objective should be production of more valid information from war games in a shorter period of time. Appreciable gains appear to be available if (1) the present limitations of war gaming are recognized by the Army, (2) there is a coordinated effort to provide for ready exchange of all available war gaming information and to minimize the duplication of effort, and (3) the potential of the computer is fully utilized.

RECOMMENDATIONS

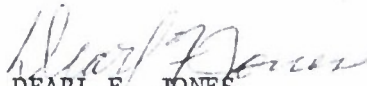
Based on the analysis contained in this paper, it is recommended that the Department of the Army take the following actions:

1. Establish a program to acquaint responsible military officers with present-day limitations of war gaming and the need for further development.

2. Expand the current coordination program into a clearing house activity to act as a source for all available information

on models, rules, analytical techniques, and weapons and equipment characteristics and to coordinate procurement of new data needed to further develop and improve war gaming.

3. Develop computer software for conducting war games and analyzing the data generated by them.


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